O. LAKE STURGEON CATCH AND ABUNDANCE PROXIMATE TO BUFFALO HARBOR, NY USA

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Introduction

Lake sturgeon life history in eastern Lake Erie is generally characterized by a dearth of stock specific information with a handful of exceptions (Koelz 1925; NYDEC 2015; USFWS 1999; USFWS 2000; Welsh et al. 2008). By contrast, far more is known of the habitat preferences, early life history, and residence patterns of lake sturgeon in the western basin (Baker and Borgeson 1999; Boase et al. 2011; Bruch and Binkowski 2002; Bur et al. 2007; Li and Jiao 2011; Roseman et al. 2011a). While data from the western basin could potentially be used to inform research efforts and hypotheses, basic questions remain about the range of the unit stock, estimates of stock size, annual reproductive output, and location and characteristics of spawning site(s) in eastern Lake Erie. Our objectives were to capture adult lake sturgeon to summarize morphometric data, and implant acoustic and satellite transmitters during the 2014-2016 spring spawning runs. These data will be used to help inform residency and usage patterns of lake sturgeon in the headwaters of the upper Niagara River in the spring and summer to facilitate future stock assessment efforts.

Methods

In 2014, Northeast Fishery Center (NEFC) staff began to coordinate sampling with an ongoing New York State Department of Environmental Conservation (NYSDEC) lake sturgeon survey. To date, lake sturgeon have only been consistently collected where mature adults are known to congregate southwest of Horseshoe Reef and the Black Rock Lock Canal Entrance Channel, locally known as the North Gap. However, lake sturgeon presence in the upper Niagara River is known only from sparse sightings and anecdotal reports.

We used gillnets for catch efforts in the area known as North Gap and the upper Niagara River between 2014 and 2016. Two types of gillnets were used. One was a 300 ft experimental monofilament net, 6 ft deep with a 60 lb leadcore line and 0.5 inch foam core float line. This net was equipped with two 50 ft panels with mesh sizes of 8.0, 10.0, and 12.0 inch stretch mesh. The other net consisted of a 300 ft experimental monofilament and multifilament net, 6 ft deep with a 60 lb leadcore line and 0.5 in foam core float line. This net was equipped with two 50 ft panels with mesh sizes of 10.0, 12.0, and 14.0 inch stretch mesh. Gillnets were set for two to four hours during daylight. The number of gillnet sets varied year to year.

In the fall of 2015 and early spring of 2016, we deployed baited setlines to explore the hypothesis that a group of lake sturgeon use the upper Niagara River (Figure O.1). Setlines for adult lake sturgeon used the methodology of Thomas and Haas (1999) though juvenile setlines used 1/0 j-hooks rather than 10/0 Sea hooks. The mother lines

were anchored and buoyed with orange buoys by day and drift poles with lights by night. In the fall of 2015, setlines for juveniles were soaked for two hours. In the spring of 2016, adult setlines were soaked for 12 hours. Lines were checked and reset once in the morning and again in the evening. No more than four setlines were deployed at any given time.

Captured lake sturgeon were equipped with several tag types in three consecutive years: in 2014, 2015, and 2016. Sampling in respective years occurred from May 15 to June 12, May 18 to June 12, and April 27 to June 1. Morphometric data were collected for each fish, and a passive integrated transponder (PIT) and anchor FLOY tag were applied at the time of capture. A subsample of lake sturgeon were also implanted with acoustic transmitters and an additional subsample were equipped with pop-off satellite archival transmitters (PSAT). We used both external and internal indicator techniques while acoustic tags were implanted to sex all captured fish. A small section of the left leading pectoral spines were removed for age estimation and fish were injected with oxytetracyline hydrochloride for partial age validation. Acoustic data were collected from implanted fish at large for a period of two years.

We set a total of two exploratory setlines for juveniles in the fall of 2015 and 31 setlines for adults in the spring of 2016 in the upper Niagara River; by-catch in all years was minimal and released unharmed at point of capture. In 2015 and 2016 respectively, gillnetting by-catch consisted of smallmouth bass (4, 2), common carp (0, 1), walleye (1, 1) redhorse spp. (1, 0), freshwater drum (1, 0), and common rudd (1, 0). No by-catch was observed in 2014.

Egg mats were deployed near netting sites, the Black Rock Lock Canal Entrance Channel (North Gap) in 2015 and north of Horseshoe Reef in 2016 to elucidate lake sturgeon egg deposition. Egg mats consisted of furnace filter wrapped around a 17 in by 22 in metal frame with float line and anchor line attached at either side. We deployed eight egg mats in 2015 and six in 2016. Egg mats were deployed between the middle and end of May while gillnets were soaking. Mats were checked daily in 2015 and once a week in 2016. Eggs were genetically identified to genus and species (see Dowell 2016 for details).

Results

Figure O.1 summarizes sampling efforts for lake sturgeon during 2015 and 2016 in the upper Niagara River and the area proximate to Buffalo Harbor. Lake sturgeon were caught southwest of Horseshoe Reef near the area locally known as the North Gap using gillnets, but no lake sturgeon were captured in the upper Niagara River in either sampling year using set lines.

Near Buffalo Harbor's North Gap, most fish were sexually mature and expressing or near to expressing gametes in all years. The vast majority of the fish we caught were sexually mature males. In 2014, no stage assignment was attempted on any netted fish. Two lake sturgeon were classified female but due to the timing of these catches early in the run, sex assignment could be suspect. In 2015, all 20 males were classified as stage two (intact, mature testes). One female was classified as stage two and the other, stage three (late yellow egg

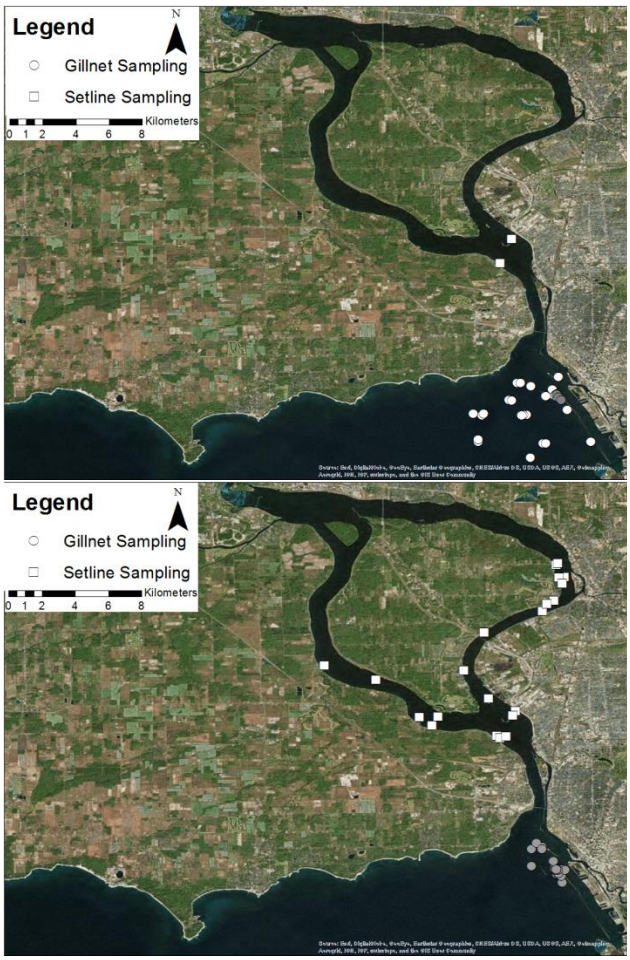

Figure O.1. (Top pane): Sampling effort in 2015. Headwaters of the upper Niagara River with locations of adult gillnet sampling (circle) and juvenile lake sturgeon setline sampling (square). Gray symbols indicate sets that resulted in catches while white symbol represent a set where no sturgeon were captured. (Bottom pane): Sampling effort in 2016. Headwaters of the upper Niagara River with locations of adult gillnet sampling (circle) and setline sampling (square). Gray symbols indicate sets that resulted in catches while white symbol represent a set where no sturgeon were captured.

female). In 2016, one male was classified as an immature (stage one) while the remaining males were classified as stage two. The single female in 2016 was a black egg female (stage four), and had a total length (73.8 inch) and weight (79.6 lbs). The majority of fish were between 30 and 75 lbs and 50 to 65 inches in length (Table O.1). Similar to prior studies, few females were netted in any study year (Table O.2). The number of total sets increased by 17 nets in 2015 due to better coordination of sampling effort between NYSDEC and NEFC and an extended sampling period (Table O.2).

TABLE O.1. Weight frequency of lake sturgeon captured near the North Gap of Buffalo Harbor North Gap, 2014 to 2016.

Weight (lbs)	Number
22.05-33.05	4
33.06-44.08	21
44.10-55.10	33
55.13-66.13	14
66.15-77.16	17
77.18-88.18	5
88.20-99.20	2
99.23-110.23	3
110.25-121.25	2
121.28-132.28	1
143.33-154.33	1
Grand Total	**103**

However, we only collected half as many lake sturgeon in 2015 relative to 2014. All captured sturgeon were successfully released at points of capture following tagging and surgery. Acoustic telemetry results are expected in a forthcoming USFWS report. Table O.3 describes the number of recaptures encountered from 2014 to 2016. The number of recaptures in 2016 was more than double of that in 2014, despite a smaller overall collection of lake sturgeon in 2016 compared to 2014. Only one recapture was encountered in 2015.

No eggs from any fish species were detected near the adult lake sturgeon capture site (North Gap) in 2015. However, eggs were collected from Bird Island Reef in 2016 and were successfully analyzed. A subsample of 26 eggs were identified as: shorthead redhorse, quillback, round goby, and white sucker (Dowell 2016). No lake sturgeon eggs were identified in 2015 or 2016.

TABLE O.2. Number of gillnet net sets by year and CPUE (total number of lake sturgeon per year/total number of net sets per year) in the vicinity of Buffalo Harbor.

Year	Gillnet Sets	CPUE Female	CPUE Male	CPUE Total
2014	22	0.14	1.36	2.00
2015	39	0.05	0.51	0.56
2016	50	0.02	0.64	0.74
Grand Total	**111**	**0.05**	**0.74**	**0.93**

TABLE O.3. Number of gill net recaptures of lake sturgeon and the proportion of recaptures in annual sample of lake sturgeon collected in the vicinity of Buffalo Harbor.

Year	Recaptures	Proportion
2014	3	0.07
2015	1	0.05
2016	7	0.19

Discussion

The area southwest of Horseshoe Reef and the Black Rock Lock Canal Entrance Channel (North Gap) is important habitat and possibly staging grounds for reproductively active lake sturgeon. Persistent catches, timing, and reproductive status support the hypothesis that lake sturgeon spawning habitat is likely in the near vicinity, though active spawning and egg collection has yet to be documented. Studies of spawning lake sturgeon indicate that lake sturgeon have specific spawning preferences driven by habitat features and environmental cues such as large boulders and rubble and site specific temperature ranges (Boase et al. 2011; Roseman et al. 2011b; Thiem et al. 2013). Bruch and Binkowski (2002) suggest that this optimal spawning temperature range is at about 8.8^{o}C (48^{o} F) to 16.0˚C (61^{o} F) which is consistent with our observations. In fact, the low catches in 2015 were likely due to delayed sampling effort that started after the minimum spawning temperature occurred.

The number of recaptures in 2015 could also reflect a sampling and spawning run mismatch; it is also possible that the number of repeat spawners reflect run/cohort specific demographic trends. Nineteen percent of fish observed in 2016 were recaptures while only seven percent of sampled fish in 2014 were recaptures, the year with the highest catches. In 2015, five percent of fish captured were recaptures (Table O.3).

All of our captures represent male-skewed data. Most females were captured in 2014 while only one was captured in 2016. However, the single 2016 female was also the second largest captured in any sampling year: 73.8 inches total length, 79.62 lbs and was extruding black eggs. The low and variable collections of females in all years could reflect cohort specific differences in spawning periodicity and demographics. It is unclear how these numbers reflect overall fecundity, egg deposition and production. Conclusions about sex and stage determination must be considered with the caveat that correct assignment of males and females is more straightforward during later stages of gonadal development, particularly when clear indicators, such as external expression of milt and eggs, are evident. When gametes were not expressed, internal sexing was conducted using non-invasive imaging technique. Although accuracy of these techniques have improved, there is still some uncertainty about correct assignment of sex and stage (Chiotti et al. 2016).

In summary, given the number of sexually mature individuals captured only southwest of Horseshoe Reef, the area could serve as a staging ground immediately prior to spawning. Males typically arrive on the spawning grounds first and demonstrate a roving behavior presumably searching for

female reproductive signals (Bruch and Binkowski 2002). Given the water temperatures when we began catching fish each year and the paucity of females in the net sets, observations to date support this hypothesis. We also expect the spawning site(s) to be near the site of these catches based on the maturity stage of netted fish. To date, no eggs or spawning activity has been documented in the headwaters of the upper Niagara River despite recent exploratory efforts. In future years, egg mats will be deployed throughout the headwaters and mainstem of the upper Niagara River to verify spawning, and acoustic telemetry will be used to direct sampling efforts more efficiently. This will serve two purposes: 1) it will help to establish the natal range for this population(s), and 2) it will inform a maturity schedule. This population remains data deficient with respect to information needed for assessing stock status. Continued annual efforts should contribute information critical to assessing stock status and formulating sound advice to advance recovery efforts of this threatened species in New York State.

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